AP Statistics- Chapter 7 Review NAME: Key

Determine what test you should use for each problem, and then perform a full test of significance.

- 1 sample T Test
  - Regular
  - Matched pairs/Mean difference
- 2 sample T Test
  - Regular
  - Pooled

1 sample t-test

1. The distribution of scores of students taking the LSATs is normally distributed with a mean of 521. We take a sample of 100 incoming Harvard Law School freshman and find a mean of 589 and a standard deviation of 37. Since Harvard is an Ivy League school, they think their freshmen are smarter than average law students. Test this theory (that Harvard students score higher than average on the LSATs) at the 0.05 significance level.

rate
RS
rmpop
or
230

Check
① assumed
② $n \geq 30$

$\mu = 521$
$\bar{x} = 589$
$n = 100$
$s = 37$
$\alpha = 0.05$

$H_0: \mu = 521$
$H_a: \mu > 521$

$t = \frac{\bar{x} - \mu}{s/\sqrt{n}} = 18.378$

$P(t > 18.378 \mid df = 99) = 5.6007 \times 10^{-34}$

- we reject H_0 b/c p-v $< \alpha = 0.05$
- we have suff. evide that Harvard had Scores

2. A teacher wants to test the effectiveness of a new textbook. She believes that this new textbook is easier to read, and that students should have better grades on their tests than they have in the past. She collected the following test scores from SRSs from all of last year's and this year's classes. Assume normal populations for both years, and assume these are SRSs from the entire population of students who use this text book. Test her theory at the 0.01 significance level.

2 sample t-test

Old book					New book				
85	84	91	75	65	94	62	86	89	80
75	82	84	89	62	96	88	88	79	75
74	64	58	95	50	94	84	86	78	64

old
$\bar{x} = 75.53$
$n = 15$
$s = 13.266$

new
$\bar{x} = 82.86$
$n = 15$
$s = 10.113$

rate
2 indep. SRS
2 normal pop.
or
$n_1, n_2 \geq 30$

Check
① circled/stated
② circled/stated

$H_0: \mu_o = \mu_n$
$H_a: \mu_o < \mu_n$

$t = \frac{\bar{x}_o - \bar{x}_n}{\sqrt{\frac{s_o^2}{n_o} + \frac{s_n^2}{n_n}}} = -1.7027$

$P(t < -1.7027 \mid df = 26.164) = 0.050$

we fail to reject b/c p-value $> \alpha = 0.01$.
we have sufficient evidence that the books ~~give~~ same avg. test scores.

ple t test

3. A football coach is frustrated with his team's lack of speed. He measures each player's 40-yard dash speed and then sends all of them to a speed and agility camp. He then measures their times again after. The data is below. Is their sufficient evidence at the 0.05 significance level to say that the camp helped the players speed?

L_1	**Before**	4.88	5.1	4.41	4.73	4.6	4.8	4.95	4.98	5.2	5.13	5.05	4.9	4.7	4.6	5.11
L_2	**After**	4.7	4.85	4.35	4.77	4.56	4.78	4.7	4.9	5	5.1	5.1	4.7	4.56	4.34	4.9

$L_3 = L_2 - L_1$

Check
① assumed
② assumed normal

$H_0: \mu_d = 0$

$H_a: \mu_d < 0$

$t = \dfrac{\bar{x}_d - \mu_d}{s_d/\sqrt{n_d}} = -4.387$

$\bar{x}_d = -0.122$
$\mu_d = 0$
$s_d = 0.1077$
$n_d = 15$
$\alpha = 0.05$

$P(t < -4.387 \mid df = 14) = 3.103 \times 10^{-4}$

- We reject H_0 b/c p-value $< \alpha = 0.05$
- We have suff. evid. that the avg diff btw. before & after the camp is less than 0, so speed increased.

4. Poisoning by DDT causes tremors and convulsions and slows recovery times of muscles. In a study of DDT poisoning, researchers fed several lab rats a measured amount of DDT. They then made measurements of the rats' refractory period (the time needed for a nerve to recover after a stimulus). They know that the mean time for unpoisoned rats is 1.3 milliseconds and that these times vary normally. In their sample they find the following times:

1.61 1.9 1.53 1.4 1.33 1.81 1.3 1.25 1.65

Test the hypotheses that DDT poisoning should slow nerve recovery and thus increase the refractory times.

Check
① assumed
② circled/stated

$H_0: \mu = 1.3$

$H_a: \mu > 1.3$

$t = \dfrac{\bar{x} - \mu}{s/\sqrt{n}} = 3.01062$

$P(t > 3.01062 \mid df = 8) = 0.0034$

- We reject H_0 b/c p-value $< \alpha = 0.05$
- We have suff. evid. that the avg refractory time increased and the poison slowed nerve recovery.

5. The Chapin Social Insight Test is a psychological test designed to measure how accurately a person appraises other people. The possible scores on the test range from 0 to 41. During the development of the test, it was given to several groups of people. Here are the results for male and female college students at a liberal arts college:

2 sample t-test

	n	x	s
Male	133	25.34	5.05
Female	162	24.94	5.10

Does the data support the contention that female and male students differ in average social insight?

$H_0: \mu_M = \mu_F$

$H_a: \mu_M \neq \mu_F$

State
① 2 indep. SRS
② 2 normal pop or $n_1, n_2 \geq 30$

Check
① assumed
③ $n_1 = 133 \not\geq 30$, $n_2 = 162$

$$t = \frac{\bar{x}_M - \bar{x}_F}{\sqrt{\frac{s_F^2}{n_F} + \frac{s_M^2}{n_M}}} = 0.6739$$

$2 \cdot P(t > 0.6739 \mid df = 282.95) = 0.5009$

We fail to reject H_0 b/c p-value $> \alpha = 0.05$.
We have suff. evid. that the avg. male & female social insight is the same

6. Look at the standard deviations of #5 again. We are told that there is evidence to say that the standard ~~deviations~~ of the 2 populations are equal. Redo this problem with this information.

2 sample t test pooled

$H_0: \mu_M = \mu_F$

$H_a: \mu_M \neq \mu_F$

State
① 2 indep. SRS
② 2 normal pop or $n_1, n_2 \geq 30$
③ $\sigma_1 = \sigma_2$

Check
① assumed
② $133, 162 \not\geq 30$
③ stated

$$t = \frac{\bar{x}_M - \bar{x}_F}{s_p \sqrt{\frac{1}{n_M} + \frac{1}{n_F}}} = 0.6733$$

$2 \cdot P(t > 0.6733 \mid df = 293) = 0.5$

* same conclusion as above